

WHAT IS CLAIMED IS:

1. A high efficiency amplifier, connected to a non-reciprocal circuit element, having an input impedance lower than a standard impedance and an output impedance substantially equal to said standard impedance, comprising:

an input terminal to receive an input signal;
an output terminal connected to said non-reciprocal circuit element;
an amplifier element to amplify said input signal; and
one or a plurality of harmonic processing circuits arranged between said amplifier element and said output terminal to process a harmonic in an output signal of said amplifier element.

2. The high efficiency amplifier according to claim 1, wherein said standard impedance is 50 ohm and an output impedance at said output terminal is substantially in the range from 3 ohm to 30 ohm.

3. The high efficiency amplifier according to claim 2, wherein at least one of said one or plurality of harmonic processing circuits matches impedance of said harmonic.

4. The high efficiency amplifier according to claim 2, wherein at least one of said one or plurality of harmonic processing circuits suppresses harmonic-related power leakage caused by said harmonic.

5. The high efficiency amplifier according to claim 2, wherein at least one of said one or plurality of harmonic processing circuits serves as an open circuit load to said harmonic.

6. The high efficiency amplifier according to claim 2, wherein at least one of said one or plurality of harmonic processing circuits serves as a short circuit load to said harmonic.

7. The high efficiency amplifier according to claim 1, wherein resonance frequency of said plurality of harmonic processing circuits are different from each other.

8. The high efficiency amplifier according to claim 1, further comprising

5 a fundamental wave regulator circuit between said amplifier element and said output terminal to perform a fine adjustment of an impedance of a fundamental wave in an output signal of said amplifier element.

9. The high efficiency amplifier according to claim 1, wherein said harmonic processing circuit is constituted of a capacitance element and a parasitic inductor coupled to said capacitance element.

10. The high efficiency amplifier according to claim 9, wherein said capacitance element is a chip capacitor.

11. The high efficiency amplifier according to claim 9, wherein said parasitic inductor is a microstrip line.

12. The high efficiency amplifier according to claim 1, further comprising

a coupled circuit arranged between said amplifier element and said output terminal, and

5 said coupled circuit includes

a first output terminal to output power of an amount corresponding to an input power to said output terminal side, and

10 a second output terminal to output power of an amount corresponding to a predetermined ratio of power output from said first output terminal.

13. The high efficiency amplifier according to claim 1, further

comprising

an output matching circuit, including said one or plurality of harmonic processing circuits, to match an impedance of an output signal of said amplifier element, and

said output matching circuit is constituted only of a signal line to transmit a signal, a bias circuit to supply a bias voltage to said amplifier element, and one or a plurality of elements connected in parallel to said signal line and having said one or plurality of harmonic processing circuits.

14. The high efficiency amplifier according to claim 1, further comprising an output matching circuit including said one or plurality of harmonic processing circuits to match an impedance of an output signal of said amplifier element, and

said output matching circuit is constituted only of a signal line to transmit a signal, a bias circuit to supply a bias voltage to said amplifier element, one or a plurality of first elements connected in parallel to said signal line and including said one or plurality of harmonic processing circuits, and one or a plurality of second elements other than a capacitance, said second elements being connected in series with said signal line.

15. A high efficiency amplifier comprising:

an input terminal to receive an input signal;

an output terminal to output a signal;

an amplifier element to amplify said input signal; and

an output matching circuit to match an impedance of an output signal from said amplifier element,

said output matching circuit being constituted only of

a signal line to transmit a signal, a bias circuit to supply a bias voltage to said amplifier element and one or a plurality of elements connected in parallel with said signal line.

16. The high efficiency amplifier according to claim 15, wherein
said one or plurality of elements are arranged between said
amplifier element and said output terminal and include a harmonic
processing circuit to process a harmonic in an output signal of said amplifier
element.

17. A high efficiency amplifier comprising:
an input terminal to receive an input signal;
an output terminal to output a signal;
an amplifier element to amplify said input signal; and
an output matching circuit to match an impedance of an output
signal of said amplifier element
said output matching circuit being constituted only of
a signal line to transmit a signal, a bias circuit to supply a bias
voltage to said amplifier element, one or a plurality of first elements
connected in parallel with said signal line, and one or a plurality of second
elements other than a capacitance, said second elements being connected in
series with said signal line.

18. The high efficiency amplifier according to claim 17 wherein
said one or plurality of first elements are arranged between said
amplifier element and said output terminal and include a harmonic
processing circuit to process a harmonic in an output signal of said amplifier
element.

19. A high efficiency amplifier comprising:
an input terminal to receive an input signal;
an output terminal to output a signal;
an amplifier element to amplify said input signal; and
an output matching circuit to match an impedance of an output
signal from said amplifier element;
said output matching circuit including a plurality of capacitance
elements to cut a direct current bias component in said input signal, and

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10 said plurality of capacitance elements being arranged in parallel
between said input terminal and said output terminal.

20. The high efficiency amplifier according to claim 19, wherein
each of said plurality of capacitance elements is a chip capacitor.

21. A high efficiency amplifier arranged between a first
transmission line of a standard impedance and a second transmission line of
an impedance lower than said standard impedance, comprising:
5 an input terminal to receive an input signal from said first
transmission line;
 an output terminal connected to said second transmission line;
 an amplifier element to amplify said input signal; and
 a low impedance line portion formed in a signal path between said
10 input terminal and said output terminal and having an adjustable
impedance.

22. The high efficiency amplifier according to claim 21 further
comprising,
5 a harmonic processing circuit arranged between said amplifier
element and said output terminal to process a harmonic in an output signal
of said amplifier element, wherein
 said standard impedance is 50 ohm, and
 an output impedance in said output terminal is substantially in the
range from 3 ohm to 30 ohm.

23. The high efficiency amplifier according to claim 21, wherein
said low impedance line portion includes
 a low impedance transmission line to transmit a signal formed to
have a portion separable from said signal path.

24. The high efficiency amplifier according to claim 21, wherein
said low impedance line portion includes

29. A high efficiency amplifier connected between a first transmission line of a first impedance and a second transmission line of a second impedance different from the first impedance, comprising:

an input terminal to receive an input signal from said first transmission line;

an output terminal connected to said second transmission line;

an amplifier element arranged between said input terminal and said output terminal to amplify said input signal and

a low impedance transmission line arranged between said input terminal and said output terminal to transmit a signal,

said low impedance transmission line being formed at a distance away from a ground potential, the distance between said low impedance transmission line and the ground potential being different from a distance between said first transmission line and the ground potential.

30. The high efficiency amplifier according to claim 29, wherein said second impedance is lower than said first impedance, and the distance between said low impedance transmission line and the ground potential is shorter than the distance between said first transmission line and the ground potential.

31. A high efficiency amplifier connected between a first transmission line of a first impedance and a second transmission line of a second impedance different from the first impedance, comprising:

an input terminal to receive an input signal from said first transmission line;

an output terminal connected to said second transmission line; and

an amplifier element arranged between said input terminal and said output terminal to amplify said input signal,

said input terminal and said output terminal being different in size according to impedance of a connected transmission line.

32. The high efficiency amplifier according to claim 31, wherein

said second impedance is lower than said first impedance and
a size of said output terminal is larger than a size of said input
terminal.

33. A radio transmission device, comprising:

a high efficiency amplifier having an output impedance lower than a
standard impedance;

5 a non-reciprocal circuit element having an input impedance lower
than said standard impedance and an output impedance substantially equal
to said standard impedance and

a transmission line to connect said high efficiency amplifier and said
non-reciprocal circuit element;

10 said high efficiency amplifier including
an input terminal to receive an input signal,
an output terminal connected to said non-reciprocal circuit element
via said transmission line,

15 an amplifier element to amplify said input signal, and
one or a plurality of harmonic processing circuits arranged between
said amplifier element and said output terminal to process a harmonic in an
output signal of said amplifier element.

34. The radio transmission device according to claim 33, wherein
said standard impedance is 50 ohm and
an output impedance in said high efficiency amplifier is
substantially in the range from 3 ohm to 30 ohm.

35. The radio transmission device according to claim 34, wherein
at least one of said one or plurality of harmonic processing circuits
matches impedance of said harmonic.

36. The radio transmission device according to claim 34, wherein
at least one of said one or plurality of harmonic processing circuits
suppresses harmonic-related power leakage caused by said harmonic.

37. The radio transmission device according to claim 34, wherein at least one of said one or plurality of harmonic processing circuits serves as an open circuit load to said harmonic.

38. The radio transmission device according to claim 34, wherein at least one of said one or plurality of harmonic processing circuits serves as a short circuit load to said harmonic.

39. The radio transmission device according to claim 33, wherein resonance frequency of said plurality of harmonic processing circuits are different from each other.

40. The radio transmission device according to claim 33, wherein said high efficiency amplifier further includes,
a fundamental wave regulator circuit between said amplifier element and said output terminal to perform a fine adjustment of an impedance of a fundamental wave in an output signal of said amplifier element.

41. The radio transmission device according to claim 33, wherein said harmonic processing circuit is constituted of a capacitance element and a parasitic inductor coupled to said capacitance element.

42. The radio transmission device according to claim 41, wherein said capacitance element is a chip capacitor.

43. The radio transmission device according to claim 41, wherein said parasitic inductor is a microstrip line.

44. The radio transmission device according to claim 33, wherein said high efficiency amplifier further includes,
a coupled circuit, arranged between said amplifier element and said output terminal, including a first output terminal to output power of an

5 amount corresponding to an input power to said output terminal side, and a second output terminal to output power of an amount corresponding to a predetermined ratio of power output from said first output terminal.

45. A radio transmission device comprising:

a high efficiency amplifier;

a non-reciprocal circuit element; and

5 a transmission line to connect said high efficiency amplifier and said non-reciprocal circuit element;

said high efficiency amplifier including,

an input terminal to receive an input signal,

an output terminal connected to said non-reciprocal circuit element via said transmission line,

10 an amplifier element to amplify said input signal, and

an output matching circuit connected to said output terminal to

match an impedance of an output signal of said amplifier element,

said output matching circuit being constituted only of

15 a signal line to transmit a signal, a bias circuit to supply a bias voltage to said amplifier element, and one or a plurality of elements connected in parallel with said signal line,

said non-reciprocal circuit element including

an input matching circuit to match an impedance of an input signal,

and

20 a capacitance element to cut a direct current bias component in said input signal being included only in said input matching circuit.

46. The radio transmission device according to claim 45, wherein an output impedance in said high efficiency amplifier is substantially in the range from 3 ohm to 30 ohm.

47. The radio transmission device according to claim 45, wherein said one or plurality of elements are arranged between said amplifier element and said output terminal and include a harmonic

processing circuit to process a harmonic in an output signal of said amplifier element,

said harmonic processing circuit includes a capacitance element and an inductor arranged in series between said signal line and a ground potential.

48. A radio transmission device comprising:

a high efficiency amplifier;

a non-reciprocal circuit element; and

a transmission line to connect said high efficiency amplifier and said non-reciprocal circuit element;

said high efficiency amplifier including,

an input terminal to receive an input signal,

an output terminal connected to said non-reciprocal circuit element via said transmission line,

an amplifier element to amplify said input signal, and

an output matching circuit connected to said output terminal to match an impedance of an output signal of said amplifier element,

said output matching circuit being constituted only of

a signal line to transmit a signal, a bias circuit to supply a bias voltage to said amplifier element, one or a plurality of first elements connected in parallel with said signal line, and one or a plurality of second elements other than a capacitance, connected in series with said signal line,

said non-reciprocal circuit element including

an input matching circuit to match an impedance of an input signal,

and

a capacitance element to cut a direct current bias component in said input signal being included only in said input matching circuit.

49. The radio transmission device according to claim 48, wherein

an output impedance in said high efficiency amplifier is substantially in the range from 3 ohm to 30 ohm.

50. The radio transmission device according to claim 48, wherein
said one or plurality of first elements are arranged between said
amplifier element and said output terminal and include a harmonic
processing circuit to process a harmonic in an output signal of said amplifier
element.

5 said harmonic processing circuit includes a capacitance element and
an inductor arranged in series between said signal line and a ground
potential.

51. A radio transmission device comprising:
a high efficiency amplifier;
a non-reciprocal circuit element; and
a transmission line to connect said high efficiency amplifier and said
non-reciprocal circuit element;
5 said high efficiency amplifier including,
an input terminal to receive an input signal,
an output terminal connected to said non-reciprocal circuit element
via said transmission line,
10 an amplifier element to amplify said input signal, and
an output matching circuit connected to said output terminal to
match an impedance of a signal output from said amplifier element,
said output matching circuit includes
a plurality of capacitance elements arranged in parallel between
15 said input terminal and said output terminal to cut a direct current bias
component in said input signal.

52. The radio transmission device according to claim 51, wherein
an output impedance in said high efficiency amplifier is
substantially in the range from 3 ohm to 30 ohm.

53. The radio transmission device according to claim 51, wherein
each of said plurality of capacitance elements is a chip capacitor.

54. A radio transmission device, comprising:
a high efficiency amplifier having an output impedance lower than a standard impedance;
a non-reciprocal circuit element having an input impedance lower
5 than said standard impedance and an output impedance substantially equal to said standard impedance; and
a transmission line to connect said high efficiency amplifier and said non-reciprocal circuit element;
said high efficiency amplifier including
10 an input terminal to receive an input signal,
an output terminal connected to said non-reciprocal circuit element via said transmission line,
an amplifier element to amplify said input signal, and
a low impedance line portion formed in a signal path between said
15 input terminal and said output terminal having an adjustable impedance.

55. The radio transmission device according to claim 54, wherein said high efficiency amplifier further includes
a harmonic processing circuit arranged between said amplifier
element and said output terminal to process a harmonic in an output signal
5 of said amplifier element, and wherein
said standard impedance is 50 ohm and
an output impedance in said high efficiency amplifier is
substantially in the range from 3 ohm to 30 ohm.

56. The radio transmission device according to claim 54, wherein said low impedance line portion includes a low impedance
transmission line to transmit a signal, formed to have a portion separable
from said signal path.

57. The radio transmission device according to claim 54, wherein said low impedance line portion includes
a low impedance transmission line to transmit a signal and a pad

5 arranged at a predetermined distance away from said low impedance
transmission line and connectable with said low impedance transmission
line.

58. A radio transmission device comprising:
a substrate;
a high efficiency amplifier having an output impedance lower than a
standard impedance;
5 a non-reciprocal circuit element having an input impedance lower
than said standard impedance and an output impedance substantially equal
to said standard impedance; and
a low impedance line portion formed in a signal path between said
high efficiency amplifier and said non-reciprocal circuit element formed on
10 said substrate;
said low impedance line portion being formed from a low impedance
transmission line to transmit a signal and a high-dielectric constant
substrate with a dielectric constant different from said substrate.

59. The radio transmission device according to claim 58, wherein
said high efficiency amplifier includes,
an input terminal to receive an input signal,
an amplifier element to amplify said input signal,
5 an output terminal, and
a harmonic processing circuit arranged between said amplifier
element and said output terminal to process a harmonic in an output signal
of said amplifier element,
said standard impedance is 50 ohm and
10 an output impedance in said high efficiency amplifier is
substantially in the range from 3 ohm to 30 ohm.

60. The radio transmission device according to claim 58, wherein
said high-dielectric constant substrate is formed on said substrate.

61. The radio transmission device according to claim 58, wherein said high-dielectric constant substrate is formed in said substrate.

62. A radio transmission device comprising:

a substrate;

a high efficiency amplifier having an output impedance lower than said standard impedance;

5 a non-reciprocal circuit element having an input impedance lower than said standard impedance and an output impedance substantially equal to said standard impedance; and

10 a low impedance transmission line, formed on said substrate, to connect said high efficiency amplifier and said non-reciprocal circuit element,

said low impedance transmission line being formed at a distance from a ground potential, the distance being different from a distance between a transmission line of said standard impedance and the ground potential.

63. The radio transmission device according to claim 62, wherein the distance between said low impedance transmission line and the ground potential is shorter than the distance between transmission line of said standard impedance and the ground potential.

64. A radio transmission device comprising:

a first transmission line of a first impedance;

a second transmission line of a second impedance different from the impedance of said first transmission line;

5 a high efficiency amplifier connected between said first transmission line and said second transmission line; and

a non-reciprocal circuit element connected to said second transmission line;

10 said high efficiency amplifier including an input terminal to receive an input signal from said first

transmission line,

an output terminal connected to said second transmission line, and
an amplifier element arranged between said first transmission line
and said second transmission line to amplify said input signal,

15 said input terminal and said output terminal are different in size
corresponding to an impedance of a connected transmission line.

65. The radio transmission device according to claim 64, wherein
said second impedance is lower than said first impedance and
a size of said output terminal is larger than a size of said input
terminal.

66. A measuring device comprising:

mount portion to mount a high efficiency amplifier having an output
impedance lower than a standard impedance;

5 a non-reciprocal circuit element having an input impedance lower
than said standard impedance and an output impedance substantially equal
to said standard impedance;

a transmission line to electrically connect said high efficiency
amplifier mounted on said mount portion and said non-reciprocal circuit
element; and

10 a circuit to measure an output from said non-reciprocal circuit
element.

67. The measuring device according to claim 66, wherein
an operation of said high efficiency amplifier mounted on said mount
portion is measured based on an output from said non-reciprocal circuit
element, and

5 said high efficiency amplifier includes,
an input terminal to receive an input signal,
an output terminal connected to said non-reciprocal circuit element
via said transmission line,
an amplifier element to amplify said input signal, and

- 10 a harmonic processing circuit arranged between said amplifier element and said output terminal to process a harmonic in an output signal of said amplifier element.

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